

METHOD AND CONTROL ARRANGEMENT FOR TERMINATING ACCIDENTAL
SWITCH ON OF A DEEP FRYER APPARATUS NOT FILLED WITH OIL

5 The present invention relates to a method and control arrangement for terminating
an accidental switch on of a deep fryer apparatus when it is not filled with oil, the deep
fryer apparatus comprises a vessel closed at the bottom and at the sides, and a sub-
stantially horizontally formed electric heating element being in direct contact with the oil
is placed within the vessel. Deep fat fryer apparatuses in which the temperature of the
10 oil can be raised to a required level by means of an electrically operated heating ele-
ment are often used in food industry. In the method according to the invention the tem-
perature is measured at one or more determined points of the inner space of the vessel
of the deep fryer apparatus, and by observing the measured temperature value acci-
dental switch on of the apparatus with a vessel without oil is detected and terminated at
15 the same time.

 In the field of gastronomy there are known methods in which the temperature is
continuously observed, and based on the measured values certain interventions in the
operation are done. Patent application HU 9700221 discloses a control unit for elec-
tronic control of gas-cookers and/or electric boiling plates and/or roasters, grillers and
20 the like. The control unit has an EEPROM in which time and/or temperature dependent
characteristic curves and/or cycle times are stored and also, it is adapted to store addi-
tional control settings modified relative to the ones stored in the EEPROM. Patent ap-
plication DE 19628274 discloses a safety device in which accidental switch on of
household cooking appliances or fryers is prevented by means of a decoder and an
25 automatic voltage cut-off unit. The safety device is also applicable to switch off the
cooking appliance or fryer when it is left switched on by chance. In both cases, detec-
tion of temperature takes place directly, therefore a prompt signal for performing an
automatic counter-measure can not be provided for example when accidental switch on
happens in a state entirely different from the proper use, for instance when there is no
30 oil filled in the deep fryer.

 With known apparatuses when they are switched on by accident without having oil
filled in them, the temperature of the heating element and the neighbouring parts within
the apparatus increases rapidly which usually leads to irreversible damage of the appa-
ratus before accidental switch on is detected. To avoid this a temperature sensor is

placed at one or more points within the apparatus. The signals of the sensor(s) are continuously observed and the filament current is cut off when the temperature exceeds a predetermined value. However, experience shows that only a threshold of such a value can be determined with which the damage of the apparatus is unavoidable.

5 The object of the present invention is to provide an apparatus and method with which the filament current can be cut off at an earlier point of time, that is, before the apparatus without oil filled in it would inevitably be damaged when it is switched on accidentally.

10 In the method according to the invention the derivative of the temperature measured at one or more given point(s) is defined, and the heating power is automatically cut off in order to terminate a switched on state of a deep fryer apparatus when the value of the derivative exceeds a predetermined threshold value.

15 The control arrangement according to the invention is adapted to determine the derivative of the temperature measured at one or more given point(s), and to cut off the heating power in order to automatically terminate a switched on state of a deep fryer apparatus when the value of the derivative exceeds a predetermined threshold value.

A detailed description of the invention will now be given with reference to the accompanying drawings in which:

20 Figure 1 is a diagram showing the temperature change plotted against time when the deep fryer apparatus is filled with oil;

Figure 2 is a diagram showing the temperature change plotted against time when the deep fryer apparatus is not filled with oil; and

25 Figure 3 is a diagram showing the temperature change plotted against time when the deep fryer apparatus is not filled with oil, and the heating power is cut off according to the method of the invention.

30 In Figure 1 a diagram showing the temperature change plotted against time can be seen in the case when the deep fryer apparatus is filled with oil. In the same diagram the change occurring in the power of the deep fryer apparatus (at the time of switching on and switching off) is also represented, resulting in a stepped function curve having two explicit values. It is perceptible that temperature 1 at the bottom part increases at a constant velocity, while temperature 2 in the vicinity of the surface changes almost likewise. When temperature 1 at the bottom part or temperature 2 in the vicinity

of the surface reaches a predetermined threshold value heating power is cut off automatically.

In Figure 2 a diagram showing the temperature change plotted against time can be seen in the case when the deep fryer apparatus is not filled with oil. Here, temperature 1 at the bottom part changes at a much higher velocity than temperature 2 in the vicinity of the surface. Then one of the two aforementioned temperatures may be compared to a predetermined threshold value and in case it exceeds the predetermined value heating power 4 is cut off. It is to be noted that a derivative of the temperature rise in case of Figure 1 or Figure 2 can be easily obtained on the basis of processing the measured temperature values. These derivative values 3 are marked in Figures 1 and 2. It is distinctly visible that the derivative value rises to a greater extent than the temperature itself when there is no oil filled in the apparatus. Consequently, according to the invention instead of observing the temperature the derivative value 3 of the same is observed and when this derivative value 3 reaches a predetermined threshold value heating power 4 is cut off. According to the foregoing the aforementioned temperature may be either temperature 1 at the bottom part or temperature 2 in the vicinity of the surface.

In Figure 3 a diagram showing the temperature change plotted against time can be seen when the deep fryer apparatus is not filled with oil, and the heating power is cut off according to the method of the invention. It is perceptible that the value of the derivative 3 presented by an abrupt curve provides a more appropriate reference point for observing the threshold value and to cut off the heating power 4 than direct observation of the temperatures, irrespective of the positioning of the temperature sensors within the frying pan. In this way a much shorter reaction time can be achieved, consequently the fryer apparatus would be damaged to a lesser degree.

It can be seen in the figure that local oscillations occur in the value of the derivative due to the nature of measuring and calculation, therefore it is practical to average the momentary value in a preceding time-interval window having a predetermined length, and the switched on state of the deep fryer apparatus is terminated automatically when the averaged value exceeds the threshold value.

In an alternative embodiment a plurality of different threshold values may be determined in accordance with temperature sensors positioned at a plurality of determined

points within the vessel of the deep fryer apparatus, and the switched on state of the apparatus may be terminated automatically when the value of the derivative of the temperature measured at any of the respective points exceeds the relevant threshold value.

5 The present invention can be suitably used with all kinds of frying apparatuses such as potato fryers in which the frying process takes place directly in the oil, and temperature sensors are used for control of the frying process in any case. The application of the method according to the invention is easy, since the control mechanism of the apparatus is adapted to compute the derivative (i.e. the differential quotient by the time)
10 on the basis of the temperature values which are available anyway, so there is no need for modification of the control mechanism.

 The advantage of the method according to the invention is that possible damage of the deep fryer apparatus and also burning out of the heating element can be prevented.